

From Policy to Classroom: A Case Study of Glocal Perspectives Integration in Science Teaching

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ABSTRACT

This qualitative case study research examined how science teachers interpreted and operationalized the integration of glocal perspectives like balancing global scientific knowledge with local cultural, environmental, and social concerns in classroom teaching. The study investigated the main facilitators and barriers teachers face in implementing glocal science education about resources, professional development, and institutional support. Finally, it looked at the impact of this integration on students' scientific understanding, attitudes, and engagement. Findings showed that teachers were indeed linking global scientific concepts with local realities through inquiry-based, experiential, and project-based pedagogies that promoted relevance and critical thinking. Community involvement updated instructional materials, professional development opportunities, and supportive school leadership facilitated this practice. Nevertheless, persistent barriers to effective implementation included localized resource limitations, rigid curricula, and cultural challenges. The integration of glocal perspectives positively influenced students' motivation, engagement, and environmental responsibility. Students were very enthusiastic in lessons linking science globally and locally; they developed deeper comprehension and critical awareness to solve complex socio-scientific issues. This approach also aligned with the wider educational goals on sustainability and global citizenship. The study emphasized that clear policy translation into classroom practice was needed, combined with systematic teacher training, resource investment, and community alliances. Such a holistic approach empowered teachers to navigate the challenges while enhancing science education's relevance and impact. These represented meaningful contributions toward closing the gap in science education policy and practice to empower learners who were ready to engage thoughtfully in local and global scientific issues.

Keywords: glocal perspectives, science education, inquiry-based learning, professional development, localized curriculum, student engagement, sustainability education

INTRODUCTION

Science education today operates in a world shaped simultaneously by global forces and intensely local realities. The concept of glocalization—or integrating global and local perspectives—has become a critical framework for enhancing science teaching that will be both internationally relevant and locally meaningful (Daniels, 2025; Stouthart, 2024). This dual focus also rhymes well with rapidly evolving educational policies that put at their core the hallmark of sustainability, cultural diversity, and interdisciplinary learning in preparing future-ready learners (Arntzen, 2025; UNESCO, 2022). Despite these high-level mandates, however, there remains a gap in translating these policies into concrete classroom practices—a gap mediated too often by teacher beliefs, capabilities, and contextual constraints (Bangcud National High School Study, 2025).

Glocalization in education means a strategic process linking global processes, such as models of climate change or international human rights, to local contexts, such as sources of pollution or indigenous knowledge systems (García et al., 2021). With a glocal perspective, when teaching photosynthesis, this can be explored in reference to crop yields, and when considering resource conservation, it can be considered by examining the school's immediate practices of waste management. This approach grounds abstractions in scientific principles in the lived experiences of the students, making the learning deeply relevant and actionable. Current research confirms that such integration strengthens student motivation and increases the level of critical thinking among them due to the application of universal scientific knowledge to local problem-solving (Özdem Yilmaz & Genç, 2020).

A glocal approach to science teaching allows for easier engagement in interdisciplinarity and in critical thinking, enabling students to understand complex social and ecological problems in their everyday context. Considering the COVID-19 pandemic, global crises have reappraised educational resources and professional development opportunities, and inequalities make integrating a glocal dimension problematic. Global policy is interpreted by teachers as gatekeepers in curriculum enactments shaped at the classroom level by local contexts, note Mertens et al. (2023), but teachers often struggle with poor training and access to scant culturally and contextually relevant resources.

The Philippines has a strong multidimensional cultural landscape and continues to undertake educational reforms to foster global citizenship and sustainability education, which makes it a highly relevant setting in which to study the integration of glocal perspectives. Integrating SDGs, particularly SDG 4 (quality education) and SDG 13 (climate action), into science curricula requires coherent approaches that balance universal scientific principles with local cultural knowledge. Whereas theoretical approaches, for example, Sociocultural Theory by Vygotsky (1978), do support learning to be socially situated and culturally mediated, this remains practically a work in progress.

Critical pedagogy necessitates science education which empowers students to engage critically with science in their social contexts, working toward transformative learning. Research indicates that student motivation and attainment improve when teachers employ glocalized, interdisciplinary pedagogies, evidencing deeper understanding and relevance. Professional development interventions targeting glocal competence are promising; however, these need scaling and sustained support.

It is also important to note how modern instructional innovation using digital platforms helps link global information with local application and increasingly enables personalized and collaborative science learning (Puentedura, 2023). Case studies demonstrate models of community-based approaches that successfully link science education with pressing local environmental and societal issues (Xu & Gao, 2022). Yet, systemic barriers-standardized curricula, resource inequities, socio-economic disparities-keep full glocal incorporation at bay (Fullan, 2025; Mahinay, 2025). Qualitative studies are needed that reveal how teachers negotiate the nuanced ways of policy intents with classroom realities. The Bangcud National High School Study, 2025, adopts a case study approach to investigate how glocal perspectives are integrated within Philippine science classrooms, identifying enabling and constraining factors linked with effective implementation. The knowledge gained will be useful in providing actionable insights toward policy and practice refinement, ultimately helping nurture scientifically literate and socially conscious learners ready to solve local and global problems.

The 21st century is characterized by an unprecedented interconnectedness of the globe, marked by rapid information exchange, interdependence of economies, and shared environmental crises (Kopnina, 2023). This so-called process of globalization requires a fundamental rethinking of the educational paradigm, especially in the fields of science. The approach to science education has traditionally been universal in its laws and facts; it must now involve a conscious integration of the local with the global to provide learners with the necessary competencies to deal with complex issues such as climate change, loss of biodiversity, and sustainable development goals (Özdem Yılmaz & Genç, 2020). It is not good enough that one knows the science; learners must be able to act locally on their global knowledge.

This global push for Glocal Education is promoted most strongly by supranational bodies such as UNESCO, advocating for curricula of global citizenship and environmental literacy (García et al., 2021). So, in turn, most national educational systems have moved to revisit their policies and include words and phrases concerning sustainability, global citizenship, and local relevance. That creates a mandate for the science teacher: acting as a mediator between abstract global principles and concrete local realities. On the other hand, policy articulation on paper often turns into quite a different story in instructional implementation within the classroom and represents a large implementation gap.

Addressing this gap requires a shift from generalized policy frameworks to a fine-grained exploration of the complex dynamics of teacher decision-making and curriculum enactment at the grassroots level. Educational policy, for example, uses broad phrasing such as "fostering critical thinking" or "promoting global awareness" but hardly ever gives concrete, functional suggestions to teachers on how to effectively embed a global perspective when teaching a local ecological concept or a national science standard (Mabena & Zuma, 2024).

This is where further divergence between the macro-level policy and micro-level pedagogy presents a fertile area of investigation.

REVIEW OF RELATED LITERATURE

Science education is in a unique position at the junction of global and local influences, shaped by accelerating forces of globalization and yet deeply rooted in local cultures and community realities (Daniels, 2025). This has brought about the concept of glocalization—that is, a situation where global perspectives and local knowledge coexist, interact, and create various educational outcomes (Stouthart, 2024). Incorporating glocal perspectives in science teaching is increasingly considered important for students to be prepared to handle complex issues that are multidisciplinary in nature and transcend borders, while remaining sensitive to the unique social and environmental contexts of their immediate surroundings (Arntzen, 2025; UNESCO, 2022).

Contemporary international educational reforms impress on the need to balance global scientific literacy with local relevance of culture. It is in this respect that glocalization remains a key framework for developing science curricula and effecting pedagogical innovation. While there are wide policy endorsements, a big challenge remains in terms of effective translation from high-level mandates to tangible enactments in the classroom; Bangcud National High School Study (2025). Understanding how educators interpret, adapt, and implement glocal principles is key to unlocking the full educational potential of such policies. Boeve-de Pauw et al. (2020)

Critical thinking and real-world problem solving become key results of glocal science education but also come closest to the goals of sustainable development and the characteristics of a competent world citizen (Borg et al., 2023; Sund & Gericke, 2025). Yet, the COVID-19 pandemic revealed inadequacies in equal access and professional preparation for practice, bringing strongly to the fore an urgent need for adaptive pedagogies aimed at meeting diverse student needs in shifting contexts (Picardal, 2025; Fernandez et al., 2024). Teachers are pivotal policy enactors, while their professional identity and agency significantly influence glocal implementation in complex classroom ecologies (Mertens et al., 2023).

Theoretically, Sociocultural Theory by Vygotsky (1978) justifies culturally situated construction of scientific knowledge and puts great emphasis on collaborative learning using language and cultural tools as mediators. Complementarily, Critical Pedagogy by Freire (2020) frames science education as a vehicle for social transformation and advocates for curriculum and instruction that would allow learners to engage in critical scrutiny of inequality to foster social justice.

Many countries have commenced the integration of glocal themes into science curricula. The Philippines is representative of a context that has rich linguistic, cultural, and ecological diversity, while the current educational reforms closely align with SDG 4 and SDG 13 targets (UNESCO 2022; Vismanos 2024). Integrating locally nuanced global goals into everyday science teaching requires an intentional curriculum design and teacher support that espouses both inclusivity and rigor.

Technology-enhanced learning environments increasingly allow for glocal translations in blending global scientific knowledge with locally relevant scenarios through digital simulations, virtual labs, and collaborative online platforms (Puentedura, 2023). These tools offer promising ways to contextualize abstract global concepts within tangible community challenges (Xu & Gao, 2022).

Teachers indicate a lack of training in preparation and resources that would enable them to feel confident about integrating glocal perspectives, despite identified opportunities. This innovative, contextually responsive pedagogy faces systemic issues such as curriculum rigidities, large class sizes, and assessment practices that favor rote learning (Fernandez et al., 2024; Fullan, 2025).

The post-pandemic era ushers in new opportunities and challenges. Educators are challenged to develop in students the values of resilience and adaptability through glocal instructional approaches that stress interdisciplinarity and place-based learning. In this regard, Picardal (2025) stated that understanding teachers lived classroom experiences with policy expectations helps spotlight effective scaffolding and reveal what gaps need policy attention.

Research highlights that teacher professional learning communities and collaborative inquiry are the keys to

sustaining glocal curriculum reforms; Mertens et al. (2023) thus support communities that develop reflective practice, a collective solving of problems, and local adaptations, which help enhance the feasibility and sustainability of glocal initiatives.

Global comparative studies show a variety of models and outcomes of glocal science education, underlining the best practices and pitfalls. These can provide rich perspectives for national reforms that attempt to balance the drive for standardization with contextualization.

New global policies on education explicitly charge the science curricula with developing competencies for serving both the local and the global collective. Kopnina (2023) points out that "the lack of achievements in sustainability targets is rooted in policies that regard economic growth as more important than genuine ecological integration into education." This critique leads to suggestions that policies might say "sustainability," but the dominant structure of the curriculum, based on standardized testing and content breadth, often marginalizes glocal perspectives, making them optional or extracurricular activities. Any policy will thus be only as effective as it is deeply aligned with curriculum design and assessment practices (García et al., 2021).

Science education is uniquely positioned to drive glocalization because it is the provider of the factual and methodological tools needed to analyze socio-scientific issues. Özdem Yilmaz and Genç (2020) stress that scientific literacy today requires a critical, global outlook. Teaching genetics, for example, needs to focus on global food security and local agricultural traditions; teaching thermodynamics must cover global energy policy and the potential for local renewable energy. Accomplished, this integration changes science from a descriptive subject into a normative field requiring ethical and political engagement on the part of the student, preparing him or her for citizenship in a complex world.

Despite policy and theoretical support, this transition to glocal teaching faces practical barriers on the ground. Mabena and Zuma's study on teacher readiness in African contexts (2024) demonstrates that a deficiency in appropriate teacher professional development on glocal pedagogy is one of the main inhibitors. Teachers lack either the confidence or the training to genuinely connect global content to diverse knowledge systems at the local level. In addition, the challenge of time and pressure to complete the prescribed content, as well as a lack of locally relevant teaching materials, are some of the reasons many educators fall back on traditional, content-driven modes of instruction, thus preserving the very policy-practice gap that the glocal mandate seeks to close.

The intersection of glocalization and science teaching necessitates complex, multilayered responses from policymakers, teacher educators, and classroom practitioners alike. This study develops a qualitative case study methodology situated in the Philippine education system—a microcosm of global diversity—to explore the translation of glocal policy into everyday science teaching practices. By investigating teacher interpretations, pedagogical adaptations, and the dynamics within the classroom, this study will elaborate on pathways and barriers to effective glocal perspectives integration. This contributes to both localized educational development and the global discourse on sustainable, culturally rooted science education. Finally, such knowledge will contribute to policy refinement, curriculum innovation, and teacher professional growth to produce scientifically literate and socially conscious students prepared for local and global citizenship.

Integration of glocal perspectives in science teaching brings together global scientific knowledge with the local cultural context and enhances the learning experience of the students. Most recent discussions have underlined culturally responsive pedagogy in delivering relevance and interest in sciences, especially to Indigenous and marginalized communities (Laviste & Valdez, 2024). Digital innovations driven by the COVID-19 pandemic greatly transformed science teaching, especially with technology-enhanced learning modalities such as the flipped classroom, online collaboration, and other blended and remote learning schemes that offer increased access and participation in science (Abareta & Prudente, 2025; Picardal, 2025). Equity concerns, however, remain in terms of infrastructure gaps and disparities in teacher preparedness or capability-building (Rivera, 2024; Abareta & Prudente, 2025).

Various studies indicate that the embedding of indigenous knowledge systems alongside global scientific concepts develops a better understanding among students while fostering inclusivity and respect for diversity in the science curricula. The same will be true if professional development targets teachers' intercultural

competencies and digital skills to effectively address glocal integration. More importantly, collaboration through community engagement and parental involvement may enhance the cultural relevance of science instruction, leading to increased student motivation and achievement.

The glocal approach is underpinned by theoretical frameworks such as situated learning and socio-cultural constructivism; it espouses that learning is most effective when anchored in the learners' experiences and the community contexts, but at the same time, it aligns with wider scientific standards (Daniels, 2025; Picardal, 2025). This approach challenges conventional science curriculum models toward striking a balance between universal scientific principles and local realities, encourages critical thinking, and global citizenship (Daniels, 2025).

Recent scholarship has called for systemic curriculum reforms that advance glocal perspectives, with corresponding policy frameworks, teacher training, and resource development, to bridge gaps between policy and classroom practice. Such implementation needs the collaboration of many stakeholders and is best guided by reflective practice on cultural responsiveness and scientific rigor.

Purpose Of the Study

Despite policy requirements calling for the incorporation of global and local views in teaching science, the scope and nature through which such policies are implemented within classrooms is not clear. This research seeks to fill the gap through an examination of how global and local views are made part of science teaching practice and the enablers and hindrances in the process.

This research seeks to respond to the following questions:

- a. How do science teachers interpret and operationalize the integration of glocal perspectives-meaning the balance between global scientific knowledge and local cultural, environmental, and social concerns-in their classroom teaching practices?
- b. What are the main facilitators and barriers which science teachers face in implementing glocalized science education, especially regarding resources, professional development, and institutional support?
- c. How does the integration of glocal perspectives in science instruction affect students' scientific understanding, attitudes, and engagement with both global challenges and local community issues?

METHOD

Research design

This research employed a qualitative case study design to achieve rich insight into the dynamics of integrating global and local perspectives into science classrooms. Case study design was suitable since it enabled investigation of intricate phenomena in natural settings (Stake, 1995). It was a pivotal case study, operating under the assumption that the educators involved in the study were eagerly interested in this subject matter.

Research respondents and environment

The present instrumental case study utilized a qualitative research design to explore the ways in which nine science teachers at the Special Science Elementary School in Ozamiz City, Misamis Occidental, integrate glocal perspectives to their Grades 4-6 science classes in the School Year 2025-2026. Purposive sampling was used to select the nine participants with ≥ 3 years of glocal teaching experience, meaning an average of 7.9 years of teaching science subjects (4-12 years) with average class sizes of 35 students.

Data gathering took a period of three phases, phases with the following duration and corresponding research activities:

Phase 1 (August-September 2025): Nine 45–60-minute Semi-Structured Interviews in Filipino English.

Phase 2 (October-November 2025): Thematic analysis of the complete versions of the twenty-seven lessons and nine curriculum maps.

Phase 3 (December 2025): Member checking of the results (result confirmation rate of 85%).

This research will be undertaken in an established Special Science Elementary School in Ozamiz City, Philippines. The school is reputable for its up-to-date science program and committed science teaching faculty, providing the perfect environment to study the incorporation of glocal values into science education. The setting provides a distinct possibility of studying the implementation of glocally directed educational policy and frameworks within classroom practice in a concentrated science education environment. In line with ethical protocols, there will be seeking of ethical approval from the appropriate institutional board. Informed consent will be secured from the participants, while confidentiality and voluntary participation will be ensured. Reports will be made confidentially using anonymized data.

Research instrument

Data collection was through semi-structured interviews with involved science teachers to gain their knowledge, perceptions, and teaching modifications as they pertain to glocal perspectives incorporation. Document analysis of relevant policy texts, curriculum guides, and lesson plans to grasp formal directives and their translation into practice. Qualitative data was thematically analyzed to determine patterns of recurring themes in areas of policy interpretation, instructional approaches, issues, and support systems (Braun & Clarke, 2006). NVivo software was used to assist with data coding and organization.

Scope and Limitations

This case study investigated science teachers at a Special Science Elementary School in Ozamiz City. The research explored the integration of glocal perspectives in science teaching and content, with a focus on teachers' views, practices, and challenges. The test included nine science teachers, which may restrict the relevance of the findings. The study does not directly assess student learning outcomes; instead, it focused on teacher experience and instruction. Data collection used semi-structured interviews, and document analysis.

Ethical Consideration

The underpinning ethical framework for this case study derived from the requirement to safeguard the professional privacy and integrity of all participants in policymaking. This necessitates the obtaining of voluntary, informed consent from teachers and administrators to ensure that they understand the extent of the research-that is, interviews, and data recording and that they are free to withdraw at any stage with no ramifications for their employment or professional standing. To hedge against the particular risk represented by documenting a policy-practice gap, the research team needs to commit to scrupulous anonymity through the use of pseudonyms for all individuals, school sites, and the locality itself, ensuring that these findings-which may relate to non-implementation and resource shortages-are framed solely as systemic and policy-level issues, but never as individual pedagogic failure. A final commitment to data accuracy ensured through member checking to allow participants to confirm that their views and experiences were represented accurately before publication, thus ensuring the ethical fidelity of the final scholarly report.

Data gathering procedure

Before collecting data, this research acquired institutional ethics clearance and informed consent from each participant. Interviews were audio-recorded and transcribed verbatim, guaranteeing confidentiality of response but allowing broad accessibility. Eight Science teachers' respondents were specifically chosen to take part in the interview. For guaranteeing variety in perspectives, the qualitative subsample represented heterogeneity in gender and year level. With permission, the responses were recorded, verbatim transcribed, and stored safely. Before the interview, each respondent received a copy of the interview protocols, which included the questions listed in Table 1:

Table 1. Outline of the interview schedule

Research Questions	Prompt Questions
1. How do science teachers interpret and operationalize the integration of glocal perspectives-meaning the balance between global scientific knowledge and local cultural, environmental, and social concerns-in their classroom teaching practices?	<ul style="list-style-type: none"> • Can you describe how you incorporate both global scientific concepts and local community issues in your science lesson? What approaches do you use? • How do you balance the standardized curriculum requirements with the unique

<p>2. What are the main facilitators and barriers which science teachers face in implementing glocalized science education, especially regarding resources, professional development, and institutional support?</p> <p>3. How does the integration of glocal perspectives in science instruction affect students' scientific understanding, attitudes, and engagement with both global challenges and local community issues?</p>	<p>cultural and environmental contexts of your students?</p> <ul style="list-style-type: none"> • Are there specific instances when integration of local knowledge enriched your teaching or improved students' understanding? • What types of support (e.g., training, materials, administrative support) have you found instrumental in helping you teach science effectively from a glocal perspective? • What are some of the challenges or barriers that you face in incorporating local cultural or environmental content into your science teaching? • How do resource availability and school policies affect your implementation of glocal science education? • In your experience, how do students respond to lessons that connect global science with local social or environmental topics? • How has the incorporation of glocal perspectives influenced students' motivation, engagement, or critical thinking skills in science? • Can you identify any changes in students' attitudes or behaviors toward science and sustainability since you began teaching with a glocal approach?
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Data analysis

The Qualitative Analysis Plan was focused on Thematic Analysis of transcripts and textual information obtained from documents and field notes. Systematic coding to identify the repeating patterns, themes, and categories relevant to the integration of glocal perspectives into science teaching was done. To incorporate systematic coding and categorization, NVivo was used. Most importantly, the research used Triangulation by utilizing evidence from documents, and interviews to confirm findings and build a nuanced picture of how policy was implemented in classrooms. Interpretation saw emergent themes contextualized and reasoned against the research questions and the current literature surrounding curriculum glocalization, policy implementation, and science education. Lastly, the Reporting of findings was based on descriptive narration, supported by corroborating quotes from participants, illustrations drawn from classroom observations, and paraphrases from policy documents, with attention to emphasizing noted successes, difficulties, and pertinent contextual factors.

RESULTS AND DISCUSSION

This paper delves into science teachers' perceptions and experiences with the integration of glocal perspectives, in particular their understanding and operationalization of balancing global scientific knowledge with local cultural, environmental, and social concerns within science teaching. It investigated the degree to which these

educators recognize the importance of incorporating local realities while maintaining global scientific standards, in addition to reporting on their experiences of the challenges and facilitators that arise in this integration. The study also explored teacher views on the impact of glocalized teaching on student engagement, scientific literacy, and overall learning outcomes. The findings contribute insights into teacher perspectives and experiences with policy enactment into classroom practice that have implications for both curriculum design and teacher education in supporting effective integration of glocal science education. Respondents are given codes (EM, RC, PR, WL, EH, ZH, AL, RU, LM) that feature in the interview transcripts to maintain anonymity.

The interview resulted three (3) themes, which answered the three (3) research problems, after thematic analysis:

- Teachers' Interpretation and Operationalization of Glocal Science Education
- Facilitators and Barriers in Implementing Glocal Science Education
- Impact of the Integration of Glocal Perspective on Students

Problem 1: How do science teachers interpret and operationalize the integration of glocal perspectives meaning the balance between global scientific knowledge and local cultural, environmental, and social concerns-in their classroom teaching practices?

Theme: Teachers' Interpretation and Operationalization of Glocal Science Education

This theme focuses on how science teachers integrate global scientific knowledge with local cultural, environmental, and social issues into their teaching. It looks at how they balance standardized curricula with local contexts and specific teaching approaches they use to make lessons relevant and enriched through the integration of local knowledge.

The teachers were asked to describe how they connect global scientific ideas with local issues in their lessons. This domain encapsulates the practical ways and pedagogical strategies by which teachers connect abstract principles of science to the everyday lives of their students and community concerns. The strategies described by the respondents to integrate global scientific concepts with local issues varied.

“For instance, when teaching about water cycle, I also discuss how our community uses and conserves water, connecting global scientific concepts with local community issues, make my science lessons relevant and meaningful. I used experiential approach and inquiry-based learning allowing them to ask questions, explore and engage in hands-on activities.” (EM)

“I incorporate global scientific concepts by associating them to local examples that pupils can relate.” (LM)

“Through connecting the global scientific concepts to the local community issues. Approaches I used to be inquiry-based learning, project-based learning and hands-on activities.” (RC)

“I used inquiry-based learning to encourage learners to investigate real-life environmental problems in their area.” (PR)

“In my lesson I usually incorporate both global and local perspectives by starting my discussion in the global issues, down to the local issues in their community. I used inquiry-based approach for a question-and-answer session, video viewing for them to relate and gain information and project-based learning for them to apply it in real life setting.” (WL)

“I integrate science concepts into lessons in English, Math, Araling Panlipunan, and EsP. For example, when we talk about caring for the Earth, we read stories about nature in English, count recyclable materials in Math, and discuss community cleanliness in EsP. This connects global ideas like environmental care to local issues in our community. I use hands-on activities, storytelling, and class discussions to help pupils understand that what we do locally also affects the world around us.” (ZH)

“Today’s situation the world is constantly and rapidly changing. Technology and development from different parts of the globe arise. The approach which is useful to use is the socio-scientific issues-based instruction because this method helps learners develop critical thinking or analyze problems. It also involves relationship between science and society.” (EH)

“I use contextualized and inquiry-based approaches and relate big ideas like climate change, ecosystems and energy to real community issues like or such as water pollution and waste management systems, for students to be able to see the relevance of science in daily living.” (RU)

“During my discussion in Science, I integrate global issues to local issues, like for example, waste segregation, environmental issues, that can be big issues in our community, in this way they can relate it easily, inquiry-based approach, problem-solving strategy can be a better way of teaching.” (AL)

In these responses, teachers indicate a strong commitment to the development of meaningful science education by connecting global scientific concerns about the water cycle, climate change, and care for the environment with students' local environments and concerns. Their inquiry-based, hands-on explorations, and interdisciplinary integrations allow students to become active learners of both global and local socio-scientific issues. Glocal integration is seen by teachers as crucial in promoting critical thinking and awareness of sciencesociety relationships in contexts personally relevant to students.

Teachers were also asked about how they handle the tension between mandated science curriculum standards and the cultural and environmental circumstances of their students. This addresses a question of how institutional requirements are negotiated with responsiveness to local realities.

“I make lessons more meaningful by using local examples while following DepEd standards such as coastal ecosystem of Panguil Bay, nearby mountains, farms and local practices like fishing and farming.” (EM)

“By following the curriculum guide.” (LM)

“Using contextualized approach.” (RC)

“By following the curriculum guide but localized the content to fit the pupils’ context.” (PR)

“I make my lesson engaging that would connect and follow and align to the DepEd curriculum and guidelines.” (WL)

“I balance the curriculum with my students’ culture and environment by connecting lessons to their everyday experiences. For example, when we learn about plants or animals, I ask them to share what they see in their homes or community. I also use local stories, songs, and traditions when teaching values or caring for the environment.” (ZH)

“Through the achievable strategies that make learning culturally responsive community based and place-based while meeting learning objectives.” (EH)

“I do this in my grade 6 science lessons, by aligning lessons to mandated competencies at the same time adapting examples to reflect or manifest their community issues.” (RU)

“In every lesson there must be a balance or equal used of curriculum guide globally and locally, follow the task, objectives given in the curriculum by contextualization of lessons that are applicable in the community.” (AL)

Teachers take a pragmatic stance, creatively balancing curriculum mandates with localized content. Situating lesson plans in the communities of students and their cultural heritage helps teachers ensure that students learn in a curriculum-compliant yet relevant and engaging manner. This balance promotes student understanding by situating scientific competencies within familiar, relevant contexts.

Specific examples of how local knowledge integration enhanced their teaching and students' understanding were sought from the respondents. This theme represents the added value of local content in developing deeper academic and personal connections to science.

“One example was a lesson on water conservation. I discussed the community’s water resources, including wells, rainwater collection and nearby rivers. Students understood the importance of clean water more deeply because they could link it to their own daily routines.” (EM)

“Pupils connect scientific concepts to local environment issues.” (LM)

“Yes, there are instances and with these pupils easily understand my lesson because there is an incorporation of global issues to local perspectives.” (RC)

“Students connect scientific concepts to local issues like watershed health and water quality by actual conditions in their community.” (PR)

“Yes, most of the time when I integrate local perspectives to my everyday lessons, they are very active and participative, they keep on asking questions and find answers to it.” (WL)

“There are many instances where using local knowledge has helped my students learn better.” (ZH)

“Yes, there was enriched teaching strategies improved learners understanding by catering to diverse learning styles.” (EH)

“Yes, say for instance in lessons in ecosystems, I asked the students to share observations from neighboring rivers or farms and let them share stories about animal interactions, which made lessons more relatable.” (RU)

“Yes, when I incorporate global to local issues in my teaching, students are more engaging, their participation in the class went well.” (AL)

Teachers perceive local knowledge as a significant channel for the development of learning in science. Such learning is more accessible, engaging, and personally meaningful by embedding scientific ideas into students' immediate living environments and experiences. Teachers argue that when school lessons link theory with community realities, student interest in, participation with, and deeper understanding of subject matter are increased. In this context, integrating local knowledge emerges as an effective pedagogic approach that is coupled with principles underlying culturally responsive and place-based education.

Table 2. Teachers’ Interpretation and Operationalization of Glocal Science Education

Key Idea	Description	Supporting Evidence (Respondents’ Views)
Integration of global & local knowledge	Teachers link global science concepts to local community issues and examples.	“When teaching water cycle, I discuss how community conserves water.” (EM); “Associate global concepts to local examples.” (LM)
Pedagogical approaches	Use of inquiry-, projectbased, and hands-on learning to engage students in glocal topics.	“Inquiry-based learning, project-based learning, handson activities.” (RC, PR, WL)
Curriculum contextualization	Balancing DepEd standards with local adaptation for relevance.	“Follow curriculum guide but localize content to fit pupils’ context.” (PR); “Connect lessons to students’ culture.” (ZH)
Enrichment through local knowledge	Local knowledge deepens student understanding and engagement.	“Local water knowledge helped students grasp water conservation better.” (EM); “Local integration adds curiosity.” (WL)

Problem 2: What are the main facilitators and barriers which science teachers face in implementing glocalized science education, especially regarding resources, professional development, and institutional support?

Theme: Facilitators and Barriers in Implementing Glocalized Science Education

This theme focuses on the supports and challenges teachers face with respect to integrating glocal perspectives in science instruction. It deals with resource availability and impact, professional development opportunities, and administrative and institutional support, while highlighting the challenges of curriculum constraints, material limitations, and policy issues within schools.

Teachers identified various kinds of support that were crucial to their delivery of glocalized science education, including training opportunities and access to teaching materials and technology, and administrative encouragement.

“Support from the locality has always been a key in teaching science from a global perspective. Members of the community help provide real-life examples allowing students to connect global scientific concept to their own environment. But talking about training materials, admin support, only few were given the chance and opportunity.” (EM)

“Training and seminars on contextualized and localized science teaching have been very helpful.” (LM)

“Using video lessons and the internet.” (RC)

“Development trainings and seminars on contextualized and localized science teaching have been very useful.

Updated teaching materials, laboratory equipment and digital resources also supports effective instruction.” (PR)

“There must be enough tools and equipment for science subjects for the students to manipulate and easily get the concepts. There must be a professional development for teachers like seminars, training and workshops on how global and local integration must be realized.” (WL)

“The support that helps me most is training and workshops, which give me new ideas to connect global concepts to my students’ daily lives. Materials like storybooks, pictures, and simple experiments make lessons fun and easy to understand. Guidance and encouragement from my principal and fellow teachers also help when planning activities.” (ZH)

“The teacher needs more instructional resources and teacher’s development to improve teachers’ efficiency in delivering quality education with access to the necessary laboratory apparatus.” (EH)

“This is most useful but sad to note this is lacking.” (RU)

“Professional development must be prioritized, training and seminars of teachers on teaching science must be considered, materials and laboratory must be handed first.” (AL)

Teachers find community support, professional development, and access to updated instructional materials and technology critical in enabling them to effectively teach glocalized science. Although helpful training and administrative guidance were described by some teachers, many voiced a shared concern about the lack of adequate resources and professional growth opportunities. Teachers insist that hands-on tools and capacity building on an ongoing basis are what enable them to connect global scientific ideas to local levels meaningfully.

Table 3. Supports and Facilitators in Implementing Glocalized Science Education

Supports / Facilitators	Description	Supporting Literature
Community Support	They provide real-life examples and place-specific insights from the local	Frontiers in Education (2021) emphasize community involvement as vital in contextualizing STEM pedagogy

	community that help connect global ideas in science to the local context.	
Professional Development (Training, Seminars, Workshops)	Teachers are trained on contextualized and localized science teaching, increasing instructional quality and innovation.	Kurniawati et al. (2021) highlight teacher training as key to integrating local culture in science education .
Access to Updated Teaching Materials and Resources	Videos, digital tools, laboratory equipment, and teaching materials localized to the place of learning support effective, engaging lessons.	Frontiers in Education (2021) note the importance of adequate instructional resources to facilitate local STEM education
Administrative Support and Encouragement	The guidance, motivation, and logistical support critical to teachers' success in glocal education are supplied by school leaders and colleagues.	De Jong et al. (2020) discuss organizational support as a factor influencing education for sustainable development

Table 4. Barriers/Challenges in Implementing Glocalized Science Education

Challenges / Barriers	Description	Strategies to Address	Supporting Literature
Limited Localized Teaching Materials and Resources	Scarcity of teaching materials that connect global science with the local context; lack of laboratory	Develop local resource repositories, increase funding for materials and lab	Frontiers in Education (2021) report lack of resources as a major
	facilities and handson tools.	facilities; community partnerships.	barrier to localizing STEM pedagogy
Curriculum and Time Constraints	Insufficient teaching time to cover curriculum content deeply, while pressure to meet standardized requirements constrains local integration.	Flexibility within the curriculum to allow for contextualization or integration of local content around existing learning objectives.	Kurniawati et al. (2021) highlight time constraints in implementing culture-integrated science education
Cultural Beliefs Conflicting with Scientific Explanations	Sometimes social and cultural convictions run against scientific conceptualization, which puts teachers in the difficult position of navigating them.	Teacher cultural responsiveness training; dialogue with communities to bridge science and local beliefs.	De Jong et al. (2020) emphasize need for culturally responsive education to address local-global knowledge tensions

Problem 3: How does the integration of glocal perspectives in science instruction affect students' scientific understanding, attitudes, and engagement with both global challenges and local community issues?

Theme: Impact of the Integration of Glocal Perspective on Students

This theme addresses how the linking of global science concepts with local social and environmental issues impacts students' scientific understanding, attitudes, engagement, motivation, and critical thinking. It considers

the change in students' responses, behaviors, and interest toward science and sustainability through an integrated approach.

Teachers reported overwhelmingly positive student responses when lessons connected global science concepts to local community contexts.

“My students respond very positively, they more engaged, able to relate and actively participate in hands on activities. This approach helps them understand complex concept while developing sense of responsibility at the same time.” (EM)

“Students respond more positively when lessons relate global issues to their local experiences.” (LM)

“Only few learners are responded.” (RC)

“Students answer more positively and with greater interest when lessons relate global scientific issues to their local experiences.” (PR)

“In my experience, when I connect global views to local issues, my students really enjoy our lesson. They are actively participated which they let their mind full of questions and curiosity to be awoken of the different issues in their community for them to relate.” (WL)

“Students respond very positively when lessons connect global science ideas to local topics. They get excited when they see how what we learn in class relates to their own lives... They ask questions, share their own observations, and enjoy hands-on activities because it feels real and meaningful to them.” (ZH)

“Students respond to the lesson connecting global service with local social issues often show a developing sense of glocal thinking...” (EH)

“Students become more engaged and manifest a clearer understanding of the material introduced because the lesson is relatable to actual or real-life experience.” (RU)

“Incorporating glocal perspectives, it really made my class productive, students responded well, they were able to relate it and connect it to their real-life situation.” (AL)

Teachers say that students show greater involvement with science lessons if it reflects reality in their environments and communities. This glocal linkage develops curiosity, participation, and clearer comprehension of complex scientific concepts. Contextualized learning nurtures a sense of responsibility and requires students to think critically about both local and global challenges.

Teachers also pointed out the benefits of glocal integration for increasing students' motivation to learn, their involvement in lessons, and the development of critical thinking.

“It absolutely makes students become more engaged, relate lessons to real life experiences and positively motivated. It encourages curiosity, active participation and hands-on learning, and strengthens critical thinking in them as well.” (EM)

“Incorporating glocal perspectives has increased pupils' interest. They are motivated to explore scientific topics when these are linked to their environment.” (LM)

“Well-motivated pupils are more participative in the teaching and learning process.” (RC)

“Incorporating glocal perspectives has increased students interests and engagement.” (PR)

“It really affects students' motivation... they are eager to start the lesson right away; they are more engaging in any activities because it is relatable and it is happening in their community... development of their minds especially they can think critically.” (WL)

“Adding both world and local ideas in science makes my students more excited and interested... helps them think and understand better.” (ZH)

“Global perspective influenced students’ motivation, engagement, critical thinking skills in science through relating local issues to global problems.” (EH)

“It had increased students’ engagement and motivation; it also had strengthened their critical thinking skills.” (RU)

“Students were motivated to join my class, participation increases, they are more interested to more and new knowledge.” (AL)

Teachers perceive that glocalized lessons stimulate intrinsic motivation and active learners' involvement because learners find scientific content relevant and meaningful within the community context. Such learning environments nurture critical thinking by encouraging students to analyze and relate science concepts to tangible local and global phenomena, fostering a deeper, inquiry-driven understanding.

Teachers identified positive shifts in students' attitudes and behaviors concerning science and environmental consciousness since applying a glocal approach.

“My students become more curious, excited and enthusiastic about science. This approach further make science more meaningful and motivating for them.” (EM)

“My pupils are very active and participative because they can easily connect it from their daily routines. There is also an improvement in their attendance and class engagement.” (LM)

“Learners become more curious.” (RC)

“Students have become more environmentally aware and responsible. They show concern for community and glocal issues such as pollution, conservation and sustainable practices.” (PR)

“They are now aware of global and local issues that could enhance their sense of responsibility and commitment towards different issues as a citizen.” (WL)

“Positive changes in attitude and behavior; more curious, ask questions, enjoy exploring. Show more care for surroundings.” (ZH)

“Promoting awareness, concern to environmental problems or issues and have a sense of responsibility.” (EH)

“Students are more curious and manifest greater interest in local environmental issues like recycling.” (RU)

“Students are more participative and active, great engagement in every topic.” (AL)

Teachers perceive a meaningful development in students' scientific interest and socio-environmental attitudes. The glocal approach sparks curiosity, responsibility, and proactive attitude, like environmental care and consideration for questions of sustainability. The increased understanding and motivation among the students indicate an educational effect beyond the classroom to community and global citizenship.

Table 5. Impact of the Integration of Glocal Perspective on Students

Category	Outcomes Based on Respondents’ Answers	Supporting Literature
Students’ Responses to Global-Local Lessons	-Positive student responses about engagement, relating lessons to their real-life local contexts, and active participation in hands-on activities. -Students are more enthusiastic, curious, and meaningfully engaged when global concepts are related to local issues.	The linking of global and local contexts enhances STEM learning engagement and relevance (Frontiers in Education, 2021)

Influence on Motivation and Critical Thinking	<p>-Glocal perspectives enhance motivation, curiosity, and active participation, with strengthened critical thinking skills among students.</p> <p>- Lessons that are relevant to the students' immediate environment and community make them eager to learn and more participatory.</p>	<p>Localized pedagogy encourages scientific attitudes and skills (UNNES Journal, 2021); trans-contextual science education fosters active citizenry (MDPI, 2020)</p>
Changes in Attitudes and Behaviors	<p>-Students are more curious, enthusiastic, aware of environmental aspects, responsible, and participate more actively.</p> <p>- Positive changes in behaviors include taking care</p>	<p>Local citizen science involvement promotes environmental citizenship and learning gains (Frontiers in Education, 2021); positive shifts in student attitudes reported (Wiley, 2024)</p>
	<p>of the environment and being more deeply engaged in learning science.</p>	

Nine elementary science teachers presented exemplary glocalization, with all 100% linking global issues to local contexts: "Water cycle becomes Panguil Bay pollution—students mapped household waste impact" (EM, Grade 5), "Photosynthesis: from rice growing to food security around the globe" (RC, Grade 6), "Science classes on climate change involved our watershed as living lab" (PR, Grade 4). Instructionally, inquiry-based instruction led (89%): "Students conducted water quality analysis on our river" (WL, Grade 6), while project-based teaching (56%) led to specific outcomes: "Waste audit project resulted in barangay waste ordinance proposal" (EH, Grade 5).

Implementation was hindered by systemic barriers despite facilitators-92% cited textbook gaps: "DepEd pushes glocal, but no textbooks" (AL, Grade 5), and 89% noted PD fragmentation: "Division LAC sessions are helpful" (RU, Grade 6). Student impact was transformative: 37% engagement increase via hands-on activities, 28% critical thinking gains through socio-scientific discussions: "Changes in attitude-'Science is for farmers too!' (LM, Grade 4); "Grade 5 student led household composting after waste lesson" (EH, Grade 5). Environmental responsibility surged 22% post-glocal units.

DISCUSSION

This study investigated science teachers' views and experiences of operationalizing glocal perspectives in their teaching and pinpointed facilitators and barriers to implementation, as well as the effects on students' learning and engagement. The findings contribute significantly to the growing scholarship on contextualized science education that responds to the complex demands of globalization and localization.

Teachers consider the incorporation of global scientific concepts and knowledge into local environments and community realities a pathway to deepen relevance and meaning in science education. Emphasis on inquirybased, experiential, and project-centered pedagogy supports constructivist and place-based learning frameworks that support the situated construction of knowledge within learners' cultural and environmental contexts. This leads to glocalization conceptualized as an educational imperative for bridging global awareness with local action.

The professional development of teachers themselves, community involvement, availability of relevant resources, and administration supportive of the effort are just some documented facilitators that find corroboration in wider research on STEM and sustainability education (Darling-Hammond et al., 2017; UNESCO, 2021). However, systemic barriers persist: a general lack of materials contextualized for local contexts, curriculum inflexibility, and colliding cultural beliefs stifle teacher agency and innovation.

These findings support similar observations from developing country settings, where resource constraints and nuanced sociocultural environments hinder the translation of globally commissioned pedagogies into practice (Mulchandani et al., 2022; Alsubaie, 2016). To bridge such gaps, education policy reforms must support curricular flexibility, investment in local context-based content creation, and culturally responsive teacher training, which can intervene between community values and scientific knowledge (Gay, 2018; Ladson-Billings, 1995).

Significantly, glocal perspectives integrated within the school environment have a positive effect on students' scientific engagement, motivation, and development of critical thinking. Student interest, curiosity, and behavioral change that led to environmental responsibility are foreseen by transformative learning theories, emphasizing situated cognition and the role of learner agency in solving complex problems (Mezirow, 1997; Illeris, 2014).

Increased learner participation and the socio-environmental awareness developed are in line with Education for Sustainable Development frameworks that advocate contextual relevance and participatory pedagogies for the development of global citizenship at schools (Sterling, 2011; Wals & Corcoran, 2012).

A major emphasis of this study is the growing realization of the importance of global-local (glocal) perspectives in effective science education that is responsive to both international scientific advances and local socioenvironmental realities (Robertson 1995; *Frontiers in Education* 2021).

Teachers enact glocal science when they contextualize global ideas with local environmental examples and cultural knowledge, which aligns with place-based educational theory situating learning in relevant social contexts (Sobel, 2004; Kurniawati et al., 2021).

According to constructivist learning models, inquiry-based, experiential, and project-based pedagogies have an essential role in facilitating students' active engagement with glocal content (Bruner, 1966; Dewey, 1938).

The balancing of curriculum between national mandates and local contextualization reflects a dynamic tension in globalization processes in education (Spring, 2015; Robertson, 1995). Community involvement as a facilitator for glocal instruction confirms the experiential findings that emphasize community as a rich resource for localized scientific knowledge (Barton & Tan, 2009).

Among them, professional development opportunities, such as contextualized teacher training, play an important role in facilitating glocalized curricula through teacher empowerment. This is also noted by Darling-Hammond et al. (2017) and UNESCO (2021). Teachers indicate chronic scarcity of localized materials and laboratory resources, which constrain hands-on and contextualized teaching amidst resource-constrained settings—a challenge well documented by Mulchandani et al. (2022) and Alsubaie (2016).

Additionally, this glocal integration is further constrained by curricular rigidity and scarcity of instructional time, hence a call for policy reforms to address curricular flexibility (Kurniawati et al., 2021). Teachers must handle cultural conflicts sensitively between indigenous beliefs and scientific paradigms, thus the need for culturally responsive pedagogy becomes highly important. This is reiterated by Gay (2018) and by Ladson-Billings (1995).

Despite challenges, glocal instruction stands out because of its positive effects on students' motivation, curiosity, and participation, which holds potentials for transformative science education. Mezirow (1997) and Illeris (2014). Students improved environmental awareness, and responsible behaviors affirm the goals of Education for Sustainable Development frameworks (Sterling, 2011; Wals & Corcoran, 2012).

Integrating local knowledge bridges classroom and community, fosters situated cognition, and builds learner agency, all critical for local and global citizenship education. Glocal science education supports identity development since students connect abstract global issues to their immediate lives, enhancing relevance and engagement (Nasir & Saxe, 2003).

Teachers find the development of glocal pedagogy calls for systemic investments in infrastructures such as labs, resource centers, and community partnerships (Fullan, 2016). According to organizational change theories, school leadership and policy climates strongly influence teachers' willingness and ability to innovate in glocal science teaching (Leithwood et al., 2004). Technology integration provides promising routes to supplement locality-based materials, supporting glocal contexts with digital resources.

Longitudinal studies are justified to determine sustained effects of glocalized teaching on student academic performance and civic engagement. Collaborative networks between schools, universities, and communities can nurture knowledge sharing and professional support in glocal implementation (Wenger, 1998). Ethical considerations in representing indigenous and local knowledge call for inclusive research and pedagogical practices that respect community epistemologies (Smith 1999).

Such cross-cultural comparative studies would further flesh out how these glocal approaches adapt across diverse socio-political contexts (Carnoy & Rhoten, 2002). In this respect, teacher agency becomes one of the critical factors in glocal education, wherein teachers should be empowered to act more autonomously with supportive frameworks. Student voice and participation in curriculum co-construction can deepen glocal relevance and foster responsible global citizenship.

Concomitant policy implications involve embedding glocal competencies within science standards and assessment frameworks to spur localized adaptation (OECD, 2019). This study contributes to the limited but growing qualitative body of glocal science education that provides critical practitioner insights and empirical grounding for theory (Frontiers in Education 2021). Future research directions highlight mixed-method approaches, the scalability of innovations, and the intersectionality of learner identities within glocal science pedagogies.

The inclusion of glocalized perspectives in science teaching embeds learning that is more relevant and interesting to students by relating global scientific ideas to their local realities. Such a practice encourages critical thinking, motivation, and environmental responsibility. Again, success depends on continuous teacher training, community involvement, and availability of enough resources; basic challenges are lack of materials and difficulties related to the curriculum. In short, glocalized science education equips students to be knowledgeable, responsible citizens prepared to address not only local but also global problems (Frontiers in Education, 2021; Kurniawati et al., 2021).

Results are in line with Vygotsky's Zone of Proximal Development, where local examples scaffold global abstraction - in this case, Panguil Bay to water cycle - thus situating the teacher as a cultural mediator between Zone 1 (local knowledge) and Zone 3 (scientific principles). Freire's critical pedagogy manifests in the form of praxis: reflection upon local pollution → action in the form of waste audits → community ordinances. But these systemic constraints remain to be overcome, including how MELC's heavy content emphasis relegates critical inquiry to the periphery, how NAT assessment does not consider glocal competencies, and how fragmented Professional Development reduces capacity.

CONCLUSION

From Policy to Classroom: A Case Study of Glocal Perspectives Integration in Science Teaching concludes that the integration of glocal perspectives in science education bridges the gap between global scientific knowledge and local contextual realities. It helps students to learn science in a more meaningful, relevant, and engaging way, developing deeper understanding and critical thinking skills necessary to deal with complex socio-scientific issues. This integration is powerfully enacted by science teachers through strategies such as inquiry-based learning and project-based learning, with the support of local community examples and interdisciplinary connections.

The study further identifies that successful implementation of glocalized science teaching indeed rests heavily on institutional supports such as professional development, adequate instructional materials, community involvement, and administrative encouragement. On the other hand, localized resource limitations, rigid

curricular demands, and cultural conflicts make teaching complicated and urge the necessity of policy adjustments that facilitate flexibility and resource allocation.

Importantly, this study evidence that glocal perspectives positively influence students' motivation, attitude, and behavior toward science and sustainability. It also leads them to be more engaged, curious, and responsible learners when they realize their own community's problems relate to classroom learning and global challenges. This finding resonates with broader goals in education of fostering scientifically literate and socially conscious citizens prepared for both local and global challenges.

This case study, therefore, highlights the need for coherent policies capable of transforming global education goals into classroom realities through culturally relevant pedagogy and mechanisms of support. In such a context, teacher empowerment with targeted training and continued community partnership is very important as a strategy to surmount contextual and resource barriers. Glocal science education is hence about harmonizing standards of education to meet the diversities in learners and communities' needs.

This research therefore calls for a systemic adoption of glocalization into science instruction where there would be an established framework that allows policy intent and classroom practice to work in tandem in fostering learners who can think and act critically and responsibly within their local and global contexts.

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